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# POSSIBILITIES OF PARTIAL CUTTING IN YOUNG WESTERN WHITE PINE

by

E. F. RAPRAEGER

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# Possibilities of Partial Cutting in Young Western White Pine

By

E. F. Rapraeger

Although acceptable cutting methods are being devised for old forests of western white pine, there is little experience at hand which pertains to young stands. Some thought and planning must be given to methods which are appropriate, inasmuch as the junior age classes will be drawn upon more and more as supplies of older timber wane. The consensus is that the cutting of young timber becomes inevitable if log-hungry millmen and dependent communities are faced with the choice of using such stands or losing their livelihood. Some of this young timber has already been cut, in accordance with procedures applicable to old forests. Though clear-cutting is a commendable measure in many mature white pine stands, the possibilities of cutting young timber in installments by means of a series of light cuts should not be overlooked.

The present paper deals with the technic of light cuts in young stands of western white pine. The intent of the paper is three-fold: (1) to call attention to what has been accomplished, (2) to point out the future possibilities, (3) to provoke and stimulate further thought on the subject. The last particularly is a desired objective.

A brief reference will be made to the circumstances which led to the preparation of the present paper. Early in 1937, I. V. Anderson of this forest experiment station called attention to the need for a study which would show the quantity, grade, and value of lumber produced by young white pine trees of different sizes and grades.[1/] Soon thereafter, an area suitable for study was found in the Bear Paw Creek drainage on the Kaniksu National Forest in northern Idaho. In September of 1937, the writer, in company with K. P. Davis of the experiment station and Roger Billings of the Kaniksu National Forest, marked the trees to be taken in the initial cut. The plot was 3 acres in area and the timber thereon, 64 years old. The total volume of pine per acre amounted to 29,000 feet log scale (trees 10 inches in diameter breast high and larger), of which 25 percent was cut for the study. Figures showed that the tree of average volume was 15 inches in diameter and that the average log scaled 61 board feet (16 logs per thousand board feet). The site was excellent.

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1/ Results of the study showing lumber yields and grades are given in a separate report entitled, "Results of a sawmill study of timber on ME plot 160 (Bear Paw Creek)," by E. F. Rapraeger. Though this report is in manuscript form only, and not prepared for general distribution, copies will be loaned upon request.

A number of foresters viewed the area after the initial cut was completed. Those who had been clear-cutting proponents immediately began to appreciate the possibilities inherent in light cuts. It is apparent, even to those who have not viewed the area, that clear-cutting too early in life results in wasteful use of the soil because too much of the rotation is spent in producing seedlings and growth on pre-merchantable stems. In sharp contrast to clear-cutting, however, light cuts permit reserved trees to continue producing wood of merchantable quality at a fairly fast rate.

Light cuts involve no hard and fast rules. Between the initial and final cuts, there may be two or three intermediate cuts or perhaps only one. For the purpose of the present discussion, a series of three will be chosen with the understanding that the same general principles apply when the number of cuts in the series is four, five, or half a dozen.

The initial cut in the series of three consists of a heavy thinning which takes about one third of the volume in marketable trees 13.6 inches in diameter breast high and larger. This cut is designed primarily to provide income at an early age, to defray the cost of necessary roads, and to give release to trees retained in the stand. Making a swing over a large property with such a cut will take some years. When the initial cut is completed the property will be fairly well developed with a permanent road system which gives easy access to the area.

In the case of the Bear Paw plot, the second cut should come when growth acceleration due to the initial cut begins to decline perceptably. This will probably be from 10 to 20 years hence. The second cut takes about one half of the remaining merchantable volume and leaves a shelterwood canopy. Its purpose is to provide income, give release to reserved trees, insure sufficient light for regeneration, and provide a seed supply.

The final cut in the series takes the remainder of the original stand after progeny have become well established. It could be deferred beyond that point if production of trees of unusually high quality is desired. The purpose of the final cut is to provide income, remove the remainder of the original stand, and give release to the regeneration.

Certain advantages are connected with these light cuts, the most important of which are listed below:

1. Release. Light cuts, by providing release from competition, promote fast growth in reserved trees and the later cuts encourage progeny, thus making the growth of the two, the old and the young, simultaneous.

2. Accessibility. Roads built during the initial cut make it easier to protect an area from destructive agencies (fire, insects, fungi). When a permanent road system has been built it is feasible to log at will, utilize secondary products when a boom market exists, and if necessary do salvage jobs.
3. Frequent cuttings. This is a solid advantage which enables the owner to work over the forest at various times during a normal rotation. Frequent cuttings make it possible to remove sickly or non-earning trees which would normally die before the end of a long rotation.
4. Preservation of natural conditions. This is very important in many areas. On steep slopes and poor sites, serious retrogression is likely to follow clear-cutting.
5. Flexibility. With light cuts the resource cannot be destroyed in one operation as so often occurs in mismanaged clear-cutting. If a mistake is made there is plenty of time for constructive follow-up action.
6. Early income. Income is obtained at an early age. Long waits for income - that bane of a forest enterprise - is partly banished.

7. Better utilization. By utilizing trees which possibly would not survive a long rotation, acreage yields are increased. In addition, jobs are provided which may never recur because the trees which provide the jobs are apt to be dead before the end of a long rotation.

Which trees to cut and which to leave merits close scrutiny of individual stems. In order to work wisely, the man who swings the marking axe needs a rather complete knowledge of silvics, tree growth, development of branches and knots, and the mechanics of logging. He must work with his head as well as his hands. He must decide whether the removal of a specific tree will release competitors. Which trees will grow fastest in volume? Which are most likely to improve in quality? Is the chosen tree sound or defective? Will it die before the next cutting cycle if not taken now? The marker must weigh these attributes and swing his axe with wisdom, keeping in mind the need for both a profitable cut and the welfare of the forest. One is useless without the other. No valid reasons exist why sound economic practice and good silvicultural tenets cannot be hitched to the same objective. Good forestry practice rests on a foundation of both.

Previous studies have shown that it does not pay to cut trees under 14 inches in diameter unless they are close to the landing because their cost of manufacture will normally exceed their lumber value. This rule can be applied inflexibly. Another axiom is: Cut the least promising trees first and use the growth capacity of the soil to favor survivors. This should be done as completely as possible, bearing in mind, however, that the initial cut must be profitable and cannot consist of too large a proportion of small, low-value trees. The initial cut in a young stand can seldom, if ever, be profitable unless some of the larger trees are taken to sweeten the realization. Invariably the larger trees are dominants. The marker should never hesitate at cutting dominants which are defective or have a poor future so far as quality is concerned. Many such dominants are truly fast growing and red blooded but at the same time they tend to be coarse limbed or "wolfy" with poor prospects for quality growth. The better class of dominants can also be cut in limited numbers if they are needed to assure a profit. The utmost care should be taken, however, to avoid plundering the forest of too much growing stock which has a good future. The stand should always be in as good and usually better shape after the cut than it was before. If this cannot be accomplished, cutting should be deferred.

The reaction of a young stand to the initial cut involves some prophecy since enough information is not at hand to forecast the future accurately. Up to this time the response of the Bear Paw stand has been gratifying. No mortality has occurred in the 2-year period since cutting took place and the trees appear to have excellent health. Normally some mortality is apt to appear and become a discount to the growth. Deaths result from careless slash disposal as well as logging damage, or from natural events such as wind and insect kill, which are often temporarily stimulated by opening up the canopy. Though no figures are available, it is highly probable that the loss during a rotation is much less in stands which are lightly cut than in virgin. Virgin stands are always subject to heavy mortality. Trees die and survivors take their places. Hundreds die as competition increases. Even if stands are lightly cut some loss may be expected. In the best of stands there are straggler trees with sickly crowns which succumb in spite of release. If the initial cut and subsequent cuts are properly executed, losses can be reduced by cutting trees before they die. This increases the total yield of timber from the area. The added increment may amount to 30 to 50 percent.

Much remains to be learned about the response of young white pine stands to release. It is generally believed, however, that young trees respond more readily than older trees. One experiment which sheds light on the rate of growth of young trees is now under way at the Priest River Experimental Forest under the auspices of the Division of Silvics. It involves one acre which nourished 11,000 feet of western white pine and 6,500 feet of other species, all about 74 years old. The stand was very thrifty, well stocked, fast growing, and roughly comparable to the Bear Paw Creek condition. In the test, 4,713 feet of white pine and 4,108 feet of other species were cut, the felling comprising 52 percent of the trees by volume and consisting mainly of dominant stems, leaving a reserve stand of mainly codominants. Growth during the ensuing decade amounted to 6,453 feet (645 feet per acre per annum) or 73 percent of the logged-off footage, as shown in the table. It is probable that a good share is due to release.

Data Pertaining to Partial-Cutting Experiment

| Species | Volume at 74 years | Volume cut | Volume left | Volume 5 years later | Volume 10 years later | Growth in 10-year period |
|---|---|---|---|---|---|---|
| | Board feet per acre, Scribner Decimal C Rule | | | | | |
| White pine | 11,000 | 4,713 | 6,287 | 8,018 | 11,411 | 5,124 |
| Other species | 6,500 | 4,108 | 2,392 | 3,085 | 3,721 | 1,329 |
| Total | 17,500 | 8,821 | 8,679 | 11,103 | 15,132 | 6,453 |

Should accelerated growth be anticipated on the Bear Paw Creek plot? From a study of the past rate of growth, it was determined that about 40 years ago the Bear Paw Creek trees grew in diameter at the rate of nearly 4 inches per decade. (This, by the way, is much too fast for quality wood.) Since then the rate has continuously diminished. In the last decade, 1927-1937, diameter growth barely exceeded 1 inch. It became subnormal. Why? The reason was not hard to determine. An investigation showed that growth decreased from 4 inches to 1 inch per decade because the trees were becoming crowded. Trees which were not badly crowded maintained a faster rate of growth. It logically follows that a cutting which reduces the amount of crowding should increase the rate of growth. In view of the range in diameter growth in the Bear Paw Creek stand, a faster rate of growth should not be difficult to maintain, while the stand is young at least, by reserving the trees which are susceptible of rapid growth if released. There is no physiological necessity for slow growth when trees are young and vigorous. A growth rate of about 2 inches in diameter every decade is believed optimum for the Bear Paw tract. This, though double the recent rate, is less than the average for the past half-dozen decades.

Though the crown canopy on the plot has been altered because of cutting, many natural forest conditions have changed very little. The ground beneath the trees is moist and the soil, the sun, the rain, have restored natural vegetation on the skid trails. No erosion is noticeable. The tree tops sway in the wind more than they did before, but windthrow has not occurred. The fire hazard is nominal. Aesthetically the stand has been improved by management.

Slash on the Bear Paw Creek plot was piled and burned. Along roads and where slash is heavy, piling and burning should at all times be the recommended measure. In isolated spots where slash is light, lopping and scattering may be sufficient protection.

Worthy of special mention is the blister rust menace. Has it increased materially because the crown canopy has been altered? This question is answered in the statement on the next page which was prepared by V. D. Moss, assistant pathologist in the Division of Plant Disease Control, Bureau of Entomology and Plant Quarantine, United States Department of Agriculture.

# Ecological Effect on Ribes of the Light Cutting on the Bear Paw Creek Plot

By

V. D. Moss

From a comparison of the effect of various logging practices on the growth and regeneration of ribes and on the development of white pine blister rust within the logged areas, it is evident that the partial cutting on the Bear Paw area approaches the ideal treatment. The major reason for this is that the original closed stand conditions which inhibit or greatly deter the development of ribes were largely retained. It is very unlikely that this type of partial cut will ever cause the establishment of serious ribes populations although small numbers of ribes seedlings can be expected along skid routes and around brush pile burns following each logging job. These seedlings, however, will always be subjected to an exceedingly high rate of mortality as long as the closed canopy effect is maintained. It is believed, therefore, that the management of the Bear Paw area thus far comes closer to accomplishing the complete natural suppression of ribes than any other treatment so far examined.

Additional light cuttings on this area should not seriously affect the ribes population any more than it was influenced by the first logging if the closed canopy is maintained. If the canopy shade in the stand becomes lighter with each additional cut, the ecological conditions may be altered enough to permit a relatively large number of seedlings to become established. In order to maintain the maximum suppression of ribes on this area it will be necessary to secure a full stocking of reproduction in sufficient time before the final cut, to provide a continuous closed canopy.

Mr. Moss believes that ribes seedlings "will always be subjected to an exceedingly high rate of mortality as long as the closed canopy effect is maintained." This is the writer's opinion also. The writer also believes that the closed canopy can be maintained quite easily, up until the time the final cuts are made. These cuts are aimed at obtaining white pine reproduction. Foresters are generally agreed that conditions favorable for white pine reproduction are also propitious for establishment of ribes seedlings. In view of this, adequate stocking must be quickly obtained, and while the gaps in the canopy are being closed ribes control must be provided for. The writer believes that the cost of control will be less than in clear-cut areas because the canopy can be closed more quickly.

Little has been said about regeneration. It should be obtained before the final cut is made. (See second paragraph on page 15.) Following the initial cut little reproduction can be expected because the newly made openings in the forest provide insufficient light for successful growth of progeny. Though seedlings may appear in early years, their survival is unlikely. As explained before, the final cuts are aimed at obtaining reproduction. Before then the cuts are aimed at releasing existing trees.

The cutting system here outlined is a form of timber management which in the early life of the stand treats the trees more or less as a mass and in later years treats them minutely as individuals. The system is more complex than clear-cutting, and it naturally follows that higher technical skill is needed to administer it effectively.

It is fully recognized that natural and economic conditions limit application of the proposed method and that no inviolable rules can be written for even a single acre. With no back-log of precedent established, good judgment must be used in applying the procedure. As an aid to this end it may be helpful to discuss briefly the silvicultural and economic factors which influence applicability. The factors which seem most important are listed below:

Silvicultural conditions

1. Forest type
2. Site
3. Age of stand

Economic conditions

1. Location of area
2. Transportation facilities
3. Markets
4. Production costs

Forest type. A white pine forest is rarely a selection forest; that is, a forest which in its full development contains choice trees of all ages and diameter classes, with the small sizes continuously replenishing the diameters which are harvested. It is entirely possible, however, with man's assistance, to convert an even-aged white pine stand into a group selection forest, each group being more or less even-aged, and the size of each group depending on the size of the openings which are made during a series of successive light cuts.

Though it is a primary aim of a true selection system to have trees of all ages and diameters scattered throughout a stand, this is not the aim of this series of light cuts. This should be clearly understood. Even-agedness by groups is one aim. Another is to provide the stand throughout later life with good stems of high marketable value. This objective can be achieved by giving adequate growing space to well-formed trees which will show a good rate of growth if released. As long as these selected trees grow at a rapid rate they should be saved. The openings around these trees should be increased at fairly regular intervals, and finally there will be sufficient overhead light to promote reproduction. From that time on the growth of crop trees and reproduction

becomes simultaneous. With frequent releases it is not difficult to conceive of a final crop of trees 30 to 40 inches in diameter at 150 years of age which are interspersed among their progeny. Longer rotations for crop trees will probably be in vogue than when clear-cutting is practiced, because a profitable rate of growth can be maintained over a longer interval.

If the method is applied to a nearly pure white pine type for a full rotation, the stand at the end of the period (just before the final cut) will consist of a white pine overstory and an understory of mainly white pine seedlings and saplings - a shelterwood forest.

If applied to white pine with an understory of red cedar saplings, the stand at the end of the rotation will consist of a white pine overstory, a crop of cedar poles, and an assortment of seedlings and saplings of various species including white pine.

If applied to a white pine stand which is strongly mixed with tolerant species such as hemlock, the stand at the end of the rotation will contain mostly hemlock and its associates, assuming only white pine is logged.

Site. Since an important aim of this cutting method is to produce large, well-formed trees, its application for the present, at least, is suggested for the best sites only.

Age of stand. The age at which to make the initial cut is when the growth rate begins to slacken, assuming, of course, that there are sufficient trees of merchantable size which can be cut without depleting the growing stock. If stands are well stocked this may mean an age of 40 to 70 years on the better sites, and correspondingly higher on the poorer sites. Stands which are understocked are usually growing rapidly and should be cut later.

Location of area. That areas must be well located and accessible needs little emphasis. The initial cut is so light that ordinarily it is impractical to build roads to reach distant tracts. Fortunately, most of the best timber-producing sites in the white pine type are well located geographically. Areas on such steep ground that roads cannot be built or maintained are poorly adapted to the method.

Transportation facilities. Roads must be built with due regard to their year-by-year or at least periodic use. This means a well-planned earth road system which is kept up permanently. Transportation systems such as flumes and chutes will usually be outlawed because their life is short and their initial cost prohibitive.

Markets. The market usually favors large timber, and the situation will be emphasized as supplies of virgin timber wane. The proposed method produces larger trees than clear-cutting. Trees are given release at regular intervals and it naturally follows that they are larger at a given age than those in a stand where no release has occurred. A permanent transportation system also makes it feasible to do hurry-up logging of associate species when a boom market exists.

Production costs. Higher technical skill is needed to administer the proposed cutting method and management costs per acre will naturally be higher. With less volume cut per acre, logging costs will also rise slightly. Increased volumes per acre over the entire rotation, better quality of tree, and full control of the area should more than offset these higher costs. Future investigation may show that by adapting logging methods to the intensity of the cut, there will be no material increase in costs.

For the sake of definiteness, the preceding discussion considered the series of cuts as being three in number. As a matter of fact, with a road system at hand the cutting cycles can be very short or cutting may be done as needed. With proper regulation of the cut (no overcutting allowed) the operation might be continuous with each area being culled over each year just as a rancher culls his flock of ewes.

Those who are familiar with the Bear Paw Creek drainage and contiguous areas will probably agree that it could provide employment for a few men almost every day of the year. This employment is important because so many of the jobs are non-recurring. The jobs exist today and tomorrow, when the stand is young. They are provided by trees, many of which would die before the end of a long rotation. There are jobs for the winter, jobs for the spring, jobs for the summer. If a winter storm does damage, the windfalls are logged the following spring. There may be other trees which are ready for cutting - trees with broken tops, others which are crowding their neighbors too severely, insect-infested trees, and trees which are of a size and quality that the market demands. These trees are skidded to more or less permanent landings and loaded on trucks by mobile loaders. The white pine logs are sawed in nearby mills and pulpwood species are hauled to Spokane. Posts, poles, and fuelwood are minor products of the forest.

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Author's note:

Foresters who are interested in the application of light cuts to even-aged stands will find it well worth their while to read "Rational Forest Management," an article by Uno Walmo, which appeared in the Swedish forestry journal "Skogen" in the forepart of 1939. This article was translated by Axel J. F. Brandstrom of the Pacific Northwest Forest and Range Experiment Station, and was drawn upon by the writer in presenting the foregoing discussion.